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14. ABSTRACT

Dissipation of hurricane waves over a broad, shallow shelf were observed during the SAX04/Ripples Experiment on the Florida Panhandle Gulf Coast. Nearly complete bottom dissipation of hurricane swell waves occurred in Apalachee Bay, where the shelf is approximately 200km wide. On the narrower 85km shelf off Fort Walton Beach, peak swell energy levels decreased by approximately a factor of 3, but were still energetic enough during Hurricane Ivan to destroy many bottom-mounted instrument platforms and cause widespread coastal damage.

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LONG-TERM GOALS

There is a growing need for surface wave information on the continental shelf and beach to estimate sea state, and to provide input for models of currents, sediment transport, radar backscatter and aerosol generation. While surface wave spectra in the open ocean evolve slowly over distances of O(100-1000 km), wave properties on the continental shelf and beach are highly variable (typical length scales of 0.1-10 km) owing to a variety of topographic effects (e.g., shoaling, refraction, scattering) and strongly enhanced nonlinear interactions and dissipation. The long-term goal of this research is to develop a better understanding of the physical processes that affect the generation, propagation and dissipation of surface waves in shallow coastal waters, and improve the accuracy of models that predict the transformation of wave properties across the shelf and beach.

RESULTS

We participated in the SAX04/Ripples Experiment on the Florida Gulf Coast. In collaboration with Tom Herbers and Fabrice Ardhuin, we deployed an array of 8 bottom pressure recorders, 4 acoustic Doppler current meters and a directional wave buoy on the continental shelf extending from Ft. Walton Beach (where the main SAX04 experiments took place) to Apalachee Bay. The main objective of our study was to evaluate the attenuation of waves by bottom friction. Concurrent surveys of sediment characteristics and ripples were conducted by Peter Traykovski and Dan Hanes. During the experiment several hurricanes (Frances, Ivan, Jeanne) passed close to the experiment site. In particular, category 4 Hurricane Ivan provided an interesting data set with a maximum significant wave height of 12 m offshore of Ft. Walton Beach. Unfortunately, instrument tripods were lost at 3 out of 9 instrumented sites as a result of these extreme wave conditions. Analysis of the observations at the remaining sites showed strong dissipation of waves propagating across the continental shelf. At Ft. Walton Beach where the shelf is about 50 km wide, the spectral levels at the dominant swell peak decrease by about a factor 3 between 85 m depth and 19 m depth. Interestingly, at frequencies below the peak frequency an increase in energy levels is observed, suggesting a nonlinear energy transfer from the spectral peak to lower frequencies. The observed decay of the swell peak was even stronger in Apalachee Bay where the shelf is about 200 km wide. At 12 m depth near the coast the swell peak virtually disappeared and the spectrum was dominated by higher-frequency, locally generated waves.

REFERENCES

Sheremet, A., R. T. Guza, and T. H. C. Herbers, A new estimator for directional properties of nearshore waves, J. Geophys. Res., 110, C01001, doi:10.1029/2003JC002236, 2005. [published, refereed]

Noyes, T. J., R. T. Guza, F. Feddersen, S. Elgar, and T. H. C. Herbers, Model-data comparisons of shear waves in the nearshore, J. Geophys. Res., 110, C05019, doi:10.1029/2004JC002541, 2005. [published, refereed]

Henderson, S. M., R. T. Guza, S. Elgar, and T. H. C. Herbers, Refraction of surface gravity waves by shear waves, J. Phys. Oceanogr. 36(4), 629-635, 2006. [published, refereed]

Magne, R., K. A. Belibassakis, T. H. C. Herbers, F. Ardhuin, W. C. O'Reilly, and V. Rey, Evolution of surface gravity waves over a submarine canyon, J. Geophys. Res., 112, C01002, 2007 [published, refereed]